There is not space enough to do more than allude to the sawflies, another class of insects fearfully injurious to trees of divers kinds. Many of these Hymenoptera, as in Great Britain and other European countries, mainly of the genus *Nematus*, clear off the leaves of forest and fruit trees. Others attack firs, notably some species of Lophyrus and Lyda, as the *Lophyrus abietis*, *Lophyrus pinetum*, and *Lophyrus pini-rigidæ*, and some of the Lyda. Cameron, in his monograph of the British phytophagous Hymenoptera, states that there are fifteen species of Lophyrus in North America, and that the species of Lyda are common there.

Lophyrus abietis and *Lophyrus abbotii* appear to do the same harm in America to firs as the *Lophyrus pini* in Scottish fir plantations, whose larvæ not only eat the leaves but the bark of the young shoots, frequently occasioning great losses.

An instructive account is given in this work of the effect of temperature upon insects. It is the fashion in Great Britain to say that insects are killed by hard frosts. But they are not killed in countries—as America, for example—whose winters are far more severe. Dr. Packard, quoting Judeich and Naitsche's "Lehrbuch der Mittel-Europäischen Forstinsektenkunde," observes that "the influence of even very great cold on the normal hybernating stages of our insects is not very great. In the summer of 1854 the 'nun' moth had very generally laid its eggs in Eastern Prussia uncovered on the bark, and these did not freeze in the hard winter of 1854–55. According to the observations of Regener, openly exposed caterpillars of the pine silk-worm endured 10° F. The pupa froze at 21° F., the moth at 19° F. According to Duclaux, the eggs of the silk-worm endure well, remaining two months in a temperature of 17° F. Great fluctuations of temperature during the winter produce an abnormal interruption of the winter's rest or hibernation, and thus cause the death of many insects." It will be noticed that in all these cases the insects were unprotected, whereas there is generally some kind of protection during the winter for insects in all stages, provided by their instinct.

Not the least useful part of the Report is that treating of remedies for insect attacks, and machines and engines for applying them. Arsenical poisons, known as Paris Green and London Purple, are strongly recommended for spraying or syringing trees infested with the larvæ of beetles and sawflies, or the caterpillars of moths. These have been recently introduced into England, being advocated by the Board of Agriculture, but have not been extensively adopted yet, owing to the natural prejudice against the use of poisons. In America they are employed most extensively and with the greatest benefit. By means of these the potato beetle (*Doryphora decemlineata*) was circumvented, and the cotton and boll worms checked, and the onslaughts of many other insects materially lessened. For Aphides, Scale insects, and other insects which suck the sap of leaves, "emulsions" or washes of soft soap, or "jelly soaps," made directly from fish oil and concentrated lye, or whale-oil soap, are prescribed. Also kerosine, naphtha, and petroleum, applied in a fine spray, or mixed with soap and soap jelly, forming "emulsions." These remedies act by contact, being applied principally to insects which do not eat the leaves, as well as by making the surroundings unpleasant and unbearable. Powdered substances, as pyrethrum, hellebore, and sulphur, are not much employed for forest work, but cases frequently arise warranting their use in a limited way. Hellebore, as gooseberry growers in Kent and Cambridgeshire well know, is of especial value against all sawfly larvæ. Sulphur is valuable against the red spider (*Tetranychus telarius*), and is used alone or in connection with emulsions of kerosene.

Numerous machines are in vogue for putting on washes and powders, from the small "knapsack" machine carried on the back, to huge tanks on wheels, fitted with powerful hand-pumps and long lengths of hose, through which liquids are forced to great heights; for very high trees, tall ladders are used, which are set near the trees, upon which men mount, and direct the hose into the topmost branches. For smaller trees and shrubs, a barrel fixed on wheels, having a good force-pump with hose, is adopted. Pumps are also fitted into tanks of all shapes and sizes, and moved from place to place by hand or horse-power. To distribute the liquids there are endless nozzles or jets contrived with much ingenuity to send forth fine mists, or sprays, or continuous volumes. It will suffice to say that the best of these is the cyclone, or Riley nozzle, which is just being introduced into Great Britain.

Foresters, and all concerned in the management of woods and forests, public parks, and gardens, would do well to consult this work for information as to the various insect enemies of trees, and the best means of dealing with them. It is quite impossible in a review to give anything more than a general idea of its scope and nature.

PHYSICAL RELIGION.

Physical Religion. The Gifford Lectures delivered before the University of Glasgow in 1890. By F. Max Müller. (London: Longmans, 1891.)

THE present volume, which embodies the author's second course of Gifford Lectures, with notes and appendices, is devoted to the consideration of "Physical Religion," that is the religion which finds its object the Infinite in or behind the phenomena of Nature. The author's previous writings have made it clear that for the simplest and most abundant manifestation of this form of religion we must go to the Veda, so his first task in the lectures before us is to tell once more the familiar story of the discovery, the character, and the age of the Veda. To this survey four lectures are devoted, and, in conclusion, the author—not without duly considering all that in recent years has been urged to the contrary—reaffirms his conviction that the hymns of the Rig Veda cannot have been collected later than 1000 B.C.

In the sixth lecture the author deals with the evolution of the idea of God. It is often supposed—even by philosophers of repute—to be a sufficient account of the earliest form of religion to say that men worshipped stones and other fetishes as their gods. But, as the professor well remarks—

> "Does it never strike these theorizers that the whole secret of the origin of religion lies in that predicate, *their gods?* Where did the human mind find that concept and that name? That is the problem which has to be solved; everything else is mere child's play."

And he exhibits the process by which Agni (the Vedic god of fire), from being originally nothing but "the mover," came to be called *deva*; and it is this word *deva* which when examined yields the clue to the development, and teaches us a lesson of the highest importance :—

> "Guided by language we can see as clearly as possible how, in the case of *deva*, the idea of God grew out of the idea of light, of active light, of an awakening, shining, illuminating, and warming light. We are apt to despise the decayed seed when the majestic oak stands before our eyes, and it may cause a certain dismay in the hearts of some philosophers that the voice of God should first have spoken to man from out the fire. Still, as there is no break between *deva*, bright, as applied to Agni, the fire, and many other powers of nature, and the *Deus optimus maximus* of the Romans—nay, as the God whom the Greeks ignorantly worshipped was the same God whom St. Paul declared unto them—we must learn the lesson, and a most valuable lesson it will turn out to be, that the idea of God is the result of an unbroken historical evolution, call it a development, an unveiling, or a purification, but not of a sudden revelation."

The two following lectures are devoted to the detailed following out of the biography of Agni, who appears in a variety of characters as the sun, the fire on the hearth, lightning, the messenger between gods and men, and priest. Finally, divested of his material character altogether, he is raised to a sublimer level as creator, ruler, and judge. The value of this inquiry, into the details of which we have no space to enter, lies in the fact that it involves the refutation of two objections which are frequently urged—with or without knowledge—against natural religion by the professors of so-called supernatural religion. The first is that natural religion, though it may lead men to a conception of "gods," is powerless to suggest to them the conception of God. This is directly contradicted by the history of Agni, whom we can watch, as it were, passing through many stages of growth until he becomes in the end "a supreme god, *the* Supreme God, till his very name is thrown away, or is recognized as but one out of many names by which ancient seers in their helpless language called that which is, the One and All." Driven from this position, however, the orthodox objector usually takes up another, and contends that the supreme God of natural religion lacks some if not all of the lofty attributes which he is enabled to know and to predicate of his own God by supernatural revelation. But Prof. Max Müller's answer to this objection is equally decided :—

> "Trusting to the fragments that have been preserved to us in the Veda, to the remains of the most childish as well as the most exalted thoughts, we may say that natural religion, or the natural faculties of man under the dominion of the natural impressions of the world around us, can lead, nay, has led man step by step to the highest conception of deity, a conception that can hardly be surpassed by any of those well-known definitions of deity which so-called supernatural religions have hitherto claimed as their exclusive property."

In the ninth lecture the Professor leaves for a while the field of his special studies to glance at the history of religious ideas among other peoples than the Âryas of the Veda. And it is noteworthy that he fully recognizes the possibility that Jehovah himself may originally have been a god of fire. But we must protest against the way in which he alludes to Abraham, the legendary founder of Hebrew monotheism, as if his historical character had never been questioned. It is, of course, perfectly open to any one to believe that Abraham was a real individual, who received a "revelation," whatever that word may be defined to mean (see p. 221); but at the same time, in a course of lectures addressed to an academic audience, it should surely have been mentioned that this is an hypothesis, which Renan, for instance, among Semitic scholars, does not even take the trouble to discuss.

In the lecture on the mythological development of Agni, we would call attention to the importance assigned to *riddles* as a cause of the growth and preservation of mythology. To take a simple example :—

> "After the Âryas in India had once arrived at the conception that fire was apt to consume the fire-sticks, or that Agni had eaten his father and mother, they seem to have amused themselves by asking such questions as, Who eats his own parents? The answers given would then enter upon many details, more or less far fetched, and the question would continue to be asked between young and old people."

And we think that this is a far more natural explanation of the origin and popularity of such stories than the hypothesis, which has no external evidence to support it, that the Âryas were simply ascribing to Agni the atrocities which they practised themselves.

Finally we come to the question, What can a study of natural religion teach us? "Why," answers Prof. Max Müller, "it teaches us that religion is natural, is real, is inevitable, is universal," and he proceeds to exhibit in detail one or two of the more important implications of this great lesson. With regard to miracles, for instance :—

> "Is it not clear that in the eyes of those who believe in the omnipresence of the Moral Governor of the world, miracles, in the ordinary sense of the word, have become impossible, and that to them either every event is miraculous or no event can claim that name. Before the great miracle of the manifestation of God in nature, all other miracles vanish. There is but one eternal miracle, the revelation of the Infinite in the finite."

The Professor then shows by a series of examples that the tendency to ascribe a miraculous birth to the founders of religions is natural and widespread, and asks by what right people claim a different character for the legends of the birth of Jesus than for the similar legends told of Buddha and Mohammed. The honesty and candour with which the question is stated are specially welcome at the present time, when it is becoming the fashion with ecclesiastical amateurs in Biblical criticism to blow hot and cold, as it were, with the same infallible mouth—that is, to reject the miracles of the Old Testament, but retain those of the New. For instance, in a recent manifesto, highly recommended as providing a temporary shelter for the destitution of the semi-reasonable, there is, on the one hand, some tall talk about the imaginative performances of "a dramatizing Jew" in the Old Testament, while, on the other hand, we are gravely informed that "the Church can insist upon the truth" of all that is recorded in the New Testament. That this cheap substitute for criticism will eventually be discredited, even in England, we have no doubt whatever. Meanwhile we cordially recommend the present volume not only for the interest of its subject-matter, but as an example of the masterly application of the only method which in these inquiries can lead to sure results.

THE KARWENDEL ALPS.

Das Karwendelgebirge. Von A. Rothpletz. Separat-Abdruck aus der *Zeitschrift des Deutschen und Oesterreichischen Alpenvereins.* With Map. (München, 1888.)

THE Karwendel Alps are a mountain mass lying to the north of the valley of the Inn, between Innsbruck and Jenbach, and bounded on the east by the Achensee, on the north and west by the upper valley of the Isar, and on the south roughly by a line drawn along the Hinterauthal (the highest part of the valley of that river) to Schwaz, in the Innthal. This region has been explored and mapped by Herr Rothpletz, with the assistance of other workers, and it is described as consisting of three roughly parallel ranges. Though their peaks do not attain to a very great elevation, the higher summits ranging from 6500 feet to rather over 8200 feet, their grand cliffs of cream-coloured limestone and their pine-clad slopes afford very beautiful scenery.

In this part of the Alps the mountain masses are wholly composed of sedimentary deposits which range from the Trias to the Neocomian. The oldest are the *Werfener Schichten*, a mass of sandy shales and sandstones, often containing numerous flakes of biotite, indicative, in all probability, of the denudation of the crystalline masses which form the floor of the Mesozoic rocks in the Alpine region. They correspond in age roughly with the upper part of the Bunter in Germany and England. Then comes the remainder of the Trias, including the Muschelkalk, followed by the representatives of the Rhætic, the Lias, and other Jurassic deposits, and a part of the Neocomian, a marine series from top to bottom. Neither the last nor the Jurassic system attains to a great thickness, but both the Rhætic and the Trias are represented by great masses of rock. In the one, the *Haupt-dolomit* occasionally attains to a thickness of 500 metres; in the other, one member, the *Myophorienschichten*, is said to be equally important. Careful descriptions of each subdivision, with lists of the more characteristic fossils, are given in the memoir. Neither Cretaceous nor Tertiary strata occur to bridge over the interval between the Neocomian and the superficial Glacial or post-Glacial deposits.

The physical history of these ranges is made the subject of an elaborate discussion. Herr Rothpletz is of opinion that, at some epoch after the Neocomian and before the commencement of the folding process by which the existing Alpine ranges were upraised, the region was affected by movements which produced a system of faults. In consequence of these, a zone of upheaval was bordered on either side by one of depression. These caused important modifications in the great east and west folds, to which the Eastern Alps are due; the rocks in the two troughs were crushed together; the upheaved tracts were upthrust. A folding plate represents an ideal section of the region after the "pre-Alpine" movements, side by side with one which shows its present state.

There can be no doubt that, in explaining the physical structure of the Alps, we have to take account of much more than the later Tertiary foldings to which the formation of the mountain-chain is due, such as the old irregularities of the pre-Mesozoic land-surface; and any important system of faults could not fail to produce very marked effects. Also, it seems indubitable that there were interruptions to the downward movement in parts of the Alpine area during the later Mesozoic and the earlier Tertiary times, which may, very probably, have caused faults such as are described by Herr Rothpletz. These, it may be noticed, appear to run obliquely to the general trend of the main folds.

Herr Rothpletz, in conclusion, expresses an opinion adverse to those geologists who consider that glaciers have played an important part in the erosion of valleys, and calls especial attention to the Soiernsee, a small lake lying in a fold of the *Plattenkalk*, which, in his opinion, indicates that "the movement of flexure acted in this case with greater rapidity than the erosive action of streams or glacier."

The geological map is on a scale of 1 : 50,000; the separate memoir, of octavo size, contains 76 pages, with 9 plates and 29 smaller illustrations. It also includes a full list of works bearing on the district. So far as we can judge, it is an elaborate and valuable contribution to the knowledge of a region but little known to English travellers, who, however, occasionally pass very near to it along the margin of the beautiful Achensee.

T. G. B.

OUR BOOK SHELF.

Graphical Statics. Two Treatises on the Graphical Calculus and Reciprocal Figures in Graphical Statics. By Luigi Cremona. Translated by Thomas Hudson Beare, Professor of Engineering and Applied Mechanics, Heriot-Watt College, Edinburgh. (Oxford: Clarendon Press, 1890.)

TREATISES on this and allied subjects of the Graphical Calculus are not uncommon in our language; but, although nowadays indispensable for engineering purposes, the subject does not flourish in our theoretical courses of instruction.

The theorems of Graphics once stated—that is, drawn out carefully on the drawing-board—are obvious, or at least do not lend themselves to verbal written demonstration, so that for purposes of competitive examination, the controlling influence of modern education, the subject of Graphical Statics and Calculation is useless.

Geometrical drawing is not taught in our public schools and Universities; and the student in a technical college only requires the bare minimum of Graphics, sufficient to enable him to pass on to practical developments; so that we fear the elegant abstract theorems on the use of signs in Geometry, as applied to lines and areas, graphical multiplication, division, involution and evolution, solution of equations, centroids, rectification and graphical analysis generally, will receive but slight attention.

There is a note of defiance in the Author's Preface to the English edition of "Reciprocal Figures in Graphical Statics" (the second treatise): "At a time when it was the general opinion that problems in engineering could be solved by mathematical analysis only, Culmann's genius suddenly created Graphical Statics, and revealed how many applications graphical methods and the theories of modern (projective) geometry possessed," &c.